

# Biosecurity Risks of In-Water Cleaning of Vessels

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# Biofouling reduction

- Fuel efficiency
- Maintenance (prop polishing, etc.)
- Biosecurity
- Regulatory requirements



# Biofouling reduction

- First line of defense: fouling prevention
- Anti-fouling paint applied in drydock ~5 yrs
- Fouling builds up in unpainted and “niche” areas



**Before and  
after cleaning**

*Photos:  
Franmarine*



# Biofouling reduction

- Limited performance after ~18 months
- Periodic cleaning to remove biofouling, refresh paint
- Typically done in-water (IWC)



# IWC also presents some risks

- -contaminant release (copper, other toxins)
- -release of non-native biota
- -may damage paint, encouraging further growth

*Didemnum vexillum*



*Botrylloides spp*



*Botryllus schlosseri*



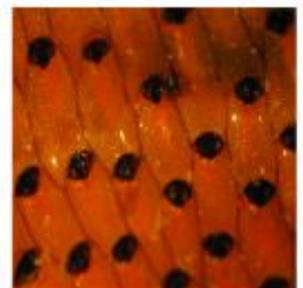
*Carcinus maenas*



*Ciona intestinalis*

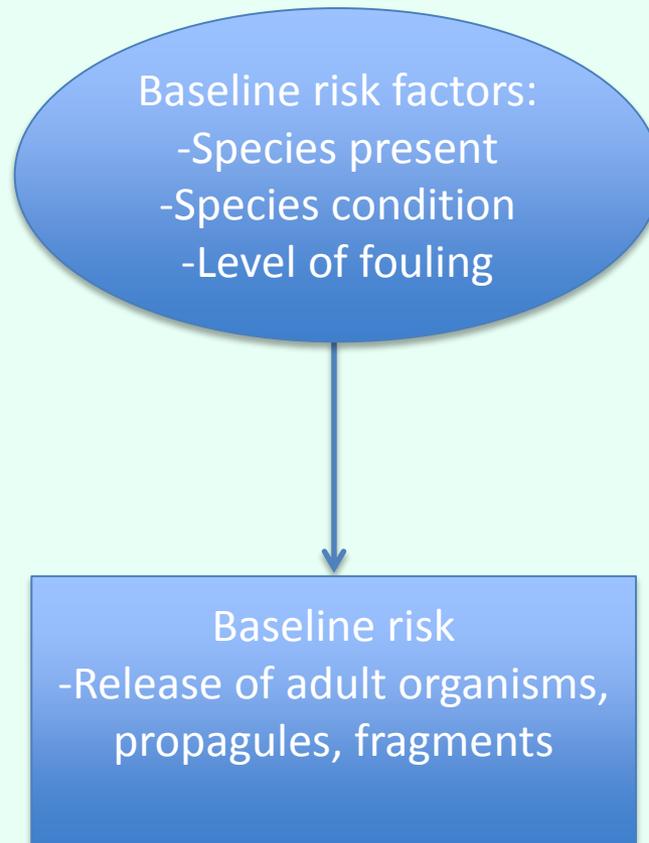


*Watersipora subtorquata*

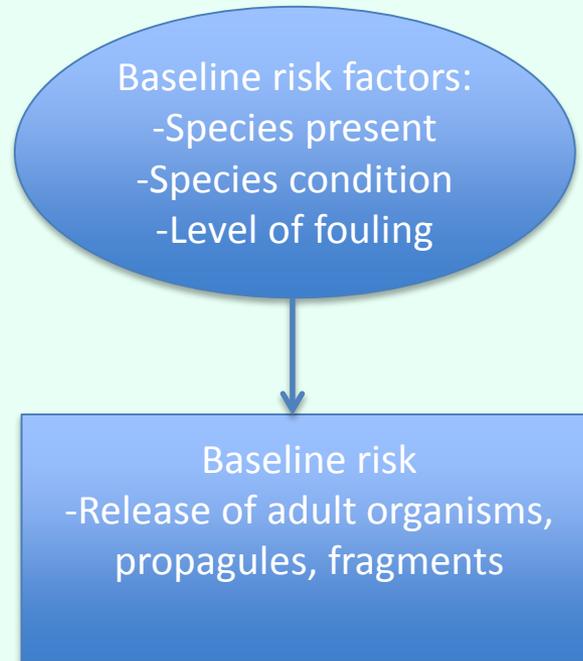


non-natives invertebrate species targeted for watch in Alaska (info at <http://platewatch.nisbase.org>)

# Assessing biosecurity risk posed by IWC of fouled vessels



# Baseline biosecurity risk



**-Does vessel travel strictly in Hawaii?**

*If yes, minimizes baseline risk*

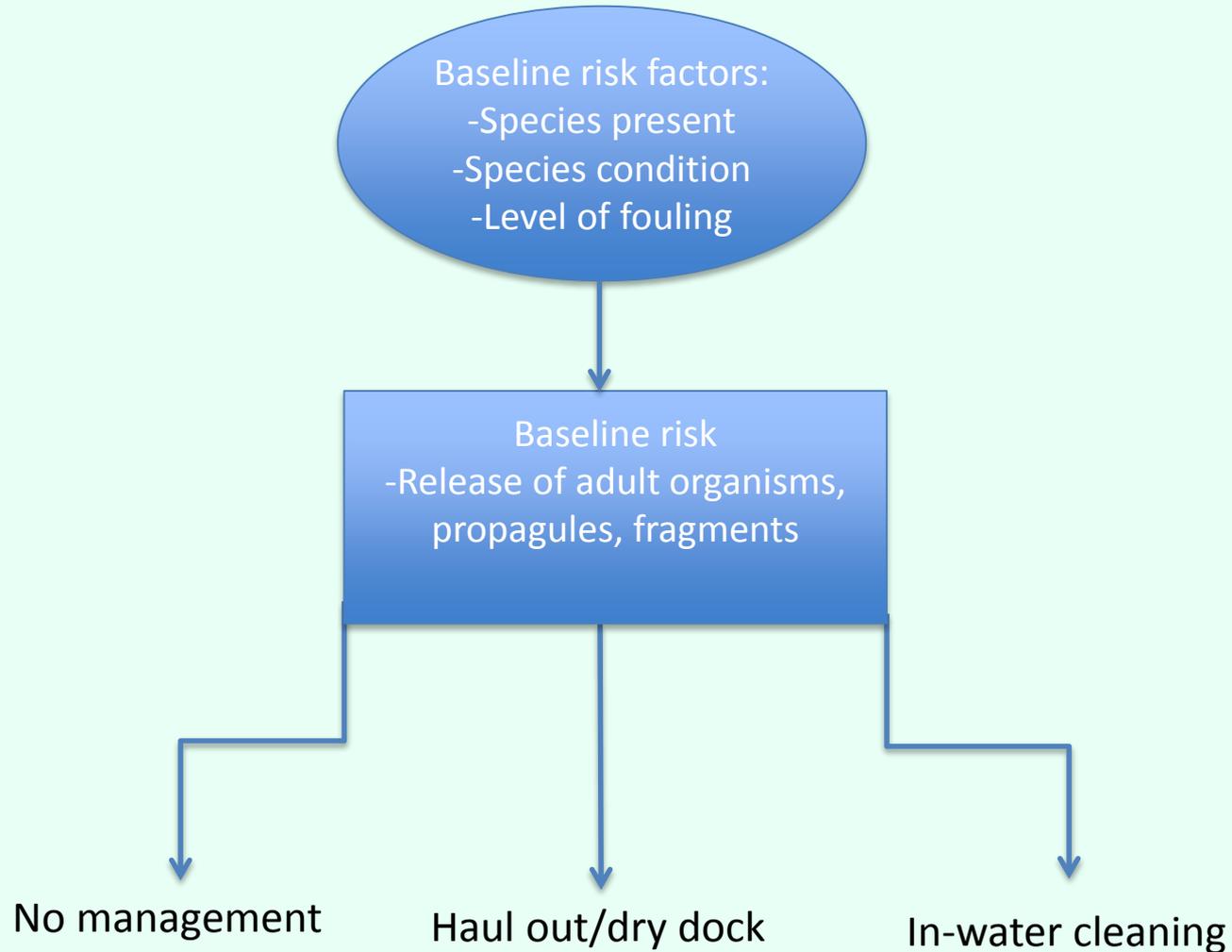
**-Condition of species?**

*Often difficult to determine*

**-Level of fouling?**

*More fouling, higher risk*

# Options for managing biofouling risk



# No-management option

Baseline risk  
-Release of adult organisms,  
propagules, fragments



No management

**-Does vessel travel strictly in Hawaii?**

*If yes, minimizes baseline risk*

**-Condition of species?**

*Often difficult to determine*

**-Level of fouling?**

*More fouling, higher risk*

**-Time spent in HI?**

*Less time, lower risk*

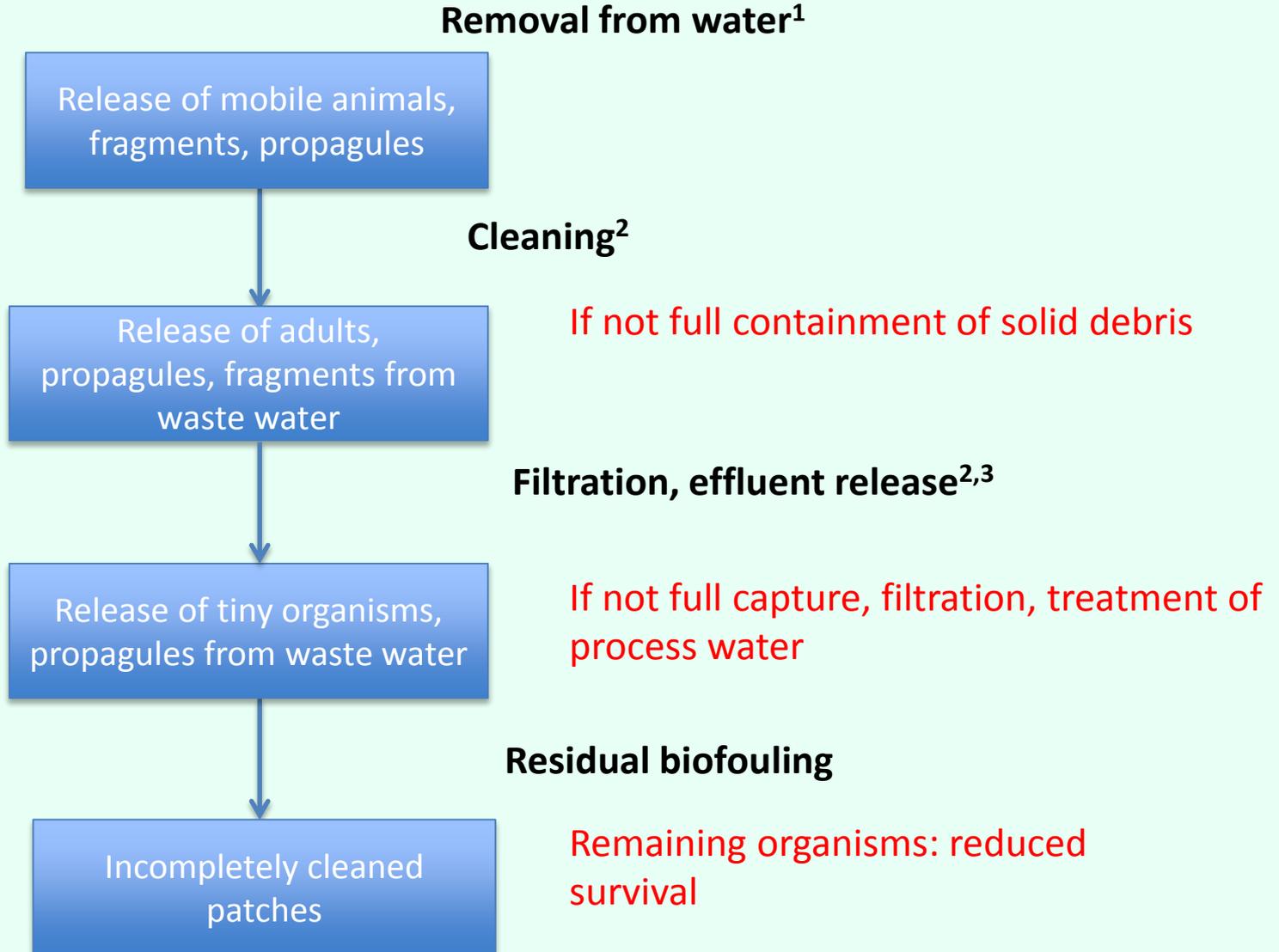
**-Movements within HI?**

*Fewer stops, lower risk*

# Dry dock/haul out option



# Dry dock/haul out option



<sup>-1</sup>Coutts et al. 2010, <sup>2</sup>Woods et al. 2012, <sup>3</sup>McClary&Nelligan 2001

# Dry dock/haul out option



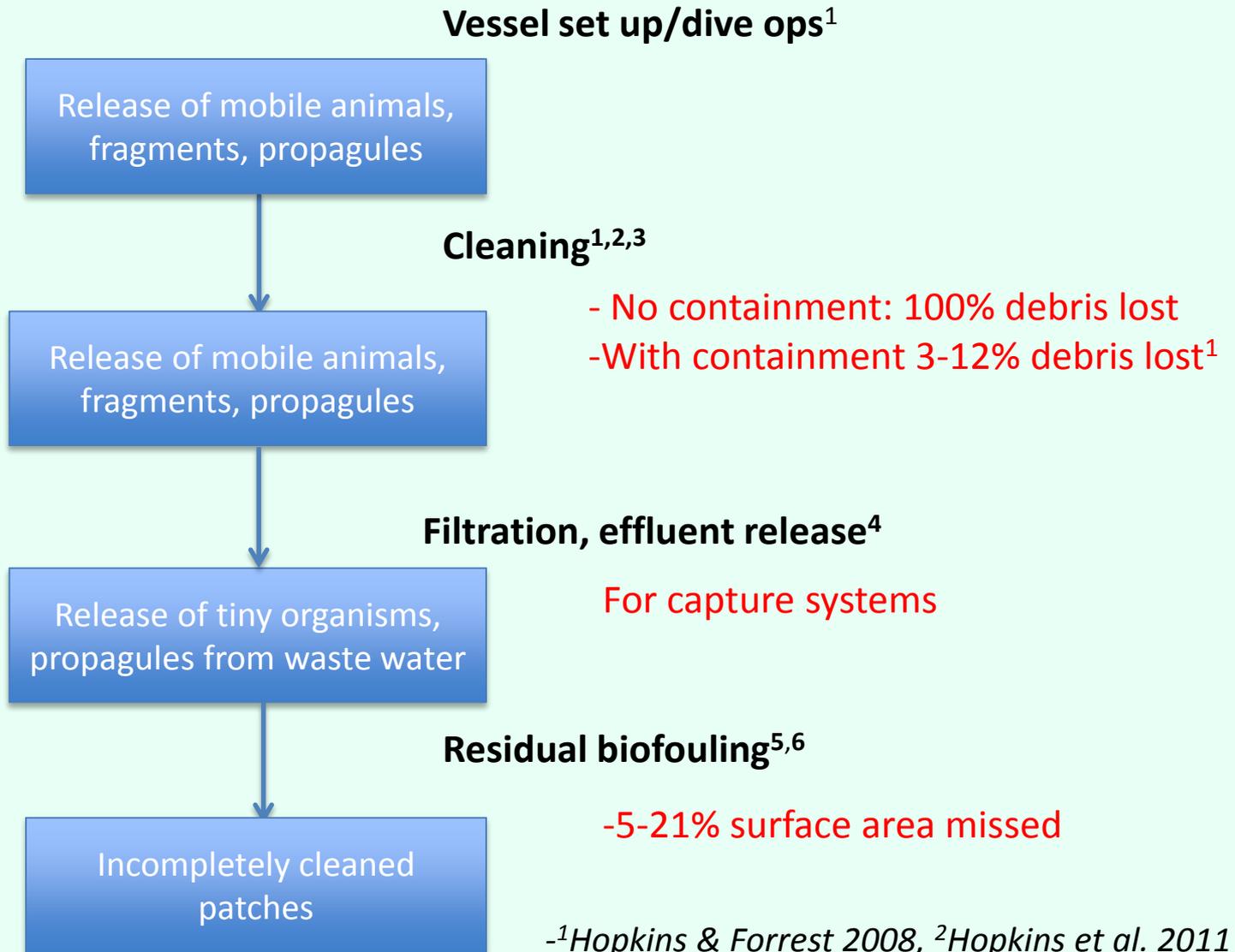
Incompletely cleaned  
patches

Remaining organisms: reduced  
survival?

# IWC option

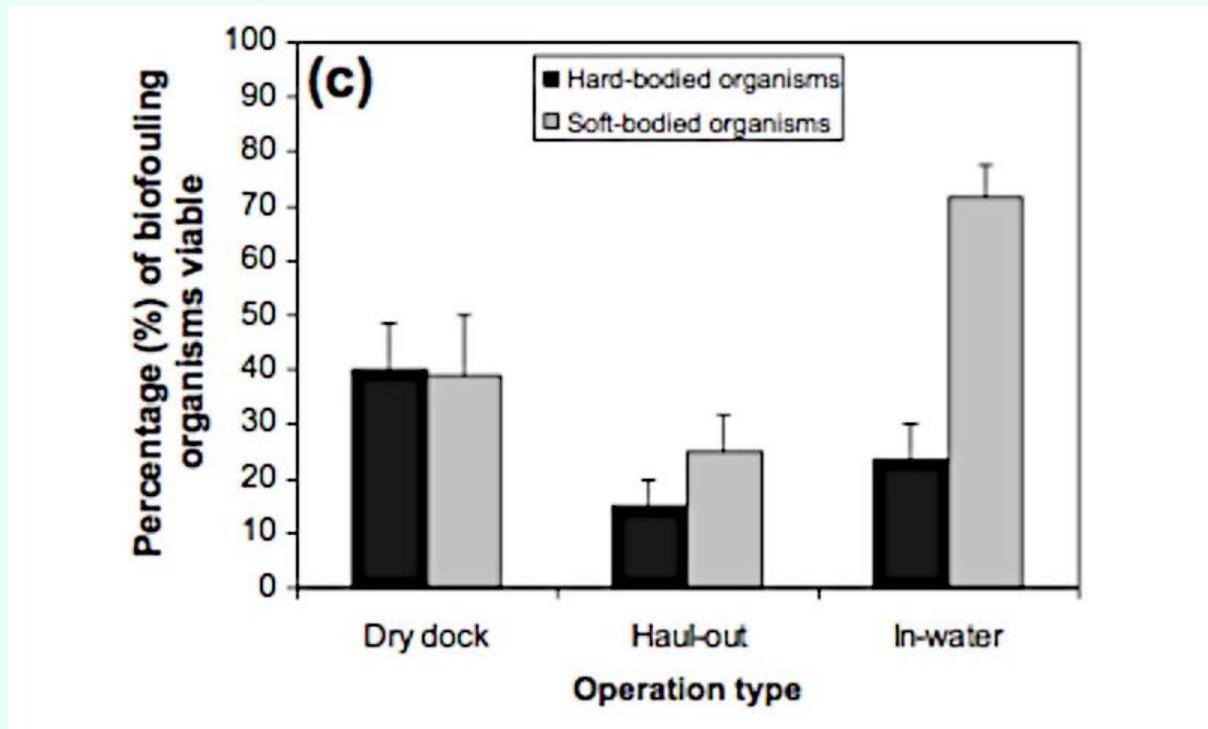


# IWC option



<sup>1</sup>Hopkins & Forrest 2008, <sup>2</sup>Hopkins et al. 2011  
<sup>3</sup>Woods et al. 2012, <sup>4</sup>McClary&Nelligan 2001,  
<sup>5</sup>Davidson et al. 2008, <sup>6</sup>Hopkins et al. 2010

# In general, IWC = greater survival



- Woods et al. 2012 comparison methods
- Floerl et al. 2003, 70% of organisms survived and viable following IWC

# Minimizing risk of IWC

- Hopkins & Forrest 2008 (NZ)
  - recognized that risks of IWC might outweigh not managing biofouling
  - Recommended careful assessment of options

# Minimizing risk of IWC

- Floerl et al. 2010 (Australia) recommended:
- Allow IWC only on vessels with non-biocidal coatings and slime layer only
- OK on heavier fouling if local origin
- Cleaning method must not damage paint
- Proactive maintenance of niche areas
- Development of capture technologies

# Minimizing risk of IWC

- Inglis et al. 2012 (NZ) reviewed various scenarios of vessel type, fouling and stays in NZ
- recommended against IWC as a management option for most non-compliant (fouled) vessels unless debris could be contained

# Options for managing biofouling risk

Baseline risk factors:

- Species present
- Species condition
- Level of fouling

Baseline risk  
-Release of adult organisms,  
propagules, fragments

-Does vessel travel strictly in HI?

*If yes, minimizes baseline risk*

-Level of fouling?

*More fouling, higher risk*

-Condition of species?

*Often difficult to determine*

-Time spent in HI?

*Less time, lower risk*

-Movements within HI?

*Fewer stops, lower risk*

No management

Haul out/dry dock

In-water cleaning

Baseline risk  
-Release of adult organisms,  
propagules, fragments

Residual risk

Residual risk

# Risk comparison

**-Does vessel travel strictly in Hawaii?**

*If yes, minimizes baseline risk*

**-Condition of species?**

*Often difficult to determine*

**-Level of fouling?**

*More fouling, higher risk*

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